

### STABILIZED TABLE RAIL CLAMP

The present application is based on and claims the benefit of U.S. provisional patent application Serial No. 60/405,630, filed August 23, 2002, the content of which is hereby incorporated by reference in its entirety.

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### BACKGROUND OF THE INVENTION

The present invention relates to a surgical retractor support apparatus. In particular, it relates to a clamping device that supports the surgical retractor support apparatus over an operating table.

Retractors are used during surgical procedures to retract the flesh at 10 the edges of a surgical incision to expose a surgical site. The retractors are typically supported by a retractor support apparatus that is positioned over the operating table and about the surgical site. The retractor support apparatus is typically secured to a side rail attached to the side of the operating table by some type of clamping device.

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In the past, two types of clamps have been used to position and attach a surgical retractor support apparatus to the side rail of an operating table. One type of clamp uses a mechanism in which a first member is pivotally attached to a second member and tightened in a jaw-like fashion around the side rail. The LeVahn, U.S. Patent No. 4,355,631 and the LeVahn et al., U.S. Patent No. 20 5,400,772, assigned to the same assignee as the present application, disclose clamping devices of this nature.

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A second type of clamp supports a retractor support apparatus by employing a clamp member and a set screw. The set screw engages the side rail which secures the clamping member to the side rail. Examples of this type of rail clamp are disclosed in the Grieshaber, U.S. Patent No. 3,040,739, and the Jascalevich, U.S. Patent No. 3,710,783.

The prior art clamping mechanisms work well in situations when a lesser force is applied to the retractor support apparatus. However, when a large

force is applied to the retractor support apparatus, the prior art clamps lack the stability to prevent the retractor support system from moving, tilting or leaning.

Another shortcoming of the prior art clamps is that the clamps are not always compatible to fit a variety of sizes of side rails. Therefore, an 5 institution may be forced to own several different clamps to perform the same surgical procedure, depending on the design of the operating table.

#### BRIEF SUMMARY OF THE INVENTION

The present invention includes a clamping device which secures a retractor support apparatus to an opening table having a side rail. The clamping 10 device includes a first clamping member disposed between a side of the operating table and the side rail. The clamping device also includes a second clamping member disposed between the side rail and the first clamping member. A first securing mechanism operably connects the first and second clamping members such that a force provided by the first securing mechanism causes the first and 15 second clamping members to move in opposing directions and frictionally engage the side of the operating table and the side rail.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view of the first embodiment of the present invention.

20 Fig. 2 is a sectional view of the first embodiment of the present invention along section line 2-2 of Fig 1.

Fig. 3 is an exploded perspective view of the first embodiment of the present invention.

25 Fig. 4 is a perspective view of a second embodiment of the present invention.

Fig. 5 is a sectional view of the second embodiment of the present invention along section line 5-5 of Fig. 4.

Fig. 6 is an exploded perspective view of the second embodiment of the present invention.

#### DETAILED DESCRIPTION

A table rail clamp of the present invention is generally illustrated in Fig. 1 at 10. A surgical table 12 typically includes a side rail 14 which is attached to a side 13 and along a length of the surgical table 12. The table rail clamp 10 includes a rail engaging portion 16 and a table engaging portion 18. Referring to Figs. 2 and 3, first and second securing mechanisms 20, 22 apply forces to the rail engaging portion 16 and the table engaging portion 18 which move the rail engaging portion 16 and the table engaging portion 18 in opposing directions thereby frictionally securing the table rail clamp 10 between the side rail 14 and the side 13 of the surgical table 12.

Referring to Figs 1-3, the rail engaging portion 16 is designed to slidably engage the side rail 14 and is positionable along the length of the side rail 14. The rail engaging portion 16 includes a first clamp plate 24 which is disposed between the side of the surgical table 12 and the side rail 14. The rail engaging portion 16 also includes a top portion 26 which connects the first clamp plate 24 and a retaining portion 28. The retaining portion 28 is spaced apart from the first clamp plate 24 and positioned substantially parallel to the first clamp plate 24 such that the first clamp plate 24, the top portion 26 and the retaining portion 28 define a slot 30. Referring to Fig. 2, a width of the slot 30 is greater than a thickness of the side rail 14 allowing the rail engaging portion 16 to freely slide upon the side rail 14 when no force is applied to the rail engaging portion 16.

Referring to Figs. 2 and 3, the table engaging portion 18 preferably is a second clamp plate which is disposed between the side 13 of the surgical table 14 and the first clamp plate 24. The table engaging portion 18 preferably includes a flat surface 19 which engages the side 13 of the table 12 which is also preferably flat. Although the preferred geometric configuration of the table engaging portion 18 is a plate, other geometric configurations are within the scope of the invention.

The table engaging portion 18 is operably attached to the rail engaging portion 16 by the first securing mechanism 20 and the second securing

mechanism 22 as best illustrated in Fig. 2. The first securing mechanism 20 is positioned above a top surface of the rail 14 and preferably above a top edge of the side 13 of the surgical table 12. The second securing mechanism 22 is positioned below a bottom surface of the side rail 14 and preferably below a bottom edge of the side 13 of the surgical table 12.

The first securing mechanism 20 includes a first threaded bore 32 disposed within the rail engaging portion 16. The first threaded bore 32 within the rail engaging portion is aligned with a first bore 34 within the table engaging portion 18. A first threaded bolt 36 threadably engages the first threaded bore 32 and operably engages a shoulder 35 within the first bore 34 within the table engaging portion 18.

Referring to Figs. 2 and 3, the first threaded bolt 36 includes an engaging ring 38. The engaging ring 38 is disposed proximate a threaded portion 40 of the first threaded bolt 36 and a selected distance from a first end 42 of the first threaded bolt 36. The table engaging portion 18 includes a cut out portion 44 about the first bore 34 which accommodates the engaging ring 38. The cut out portion 44 extends to a top end 23 of the table engaging portion 18 such that the engaging ring 38 is exposed and thereby allowing the first threaded bolt 36 to be rotated in a similar manner as a thumb screw. As the first threaded bolt 36 is rotated, the threaded engagement of the first threaded bolt 36 with the first threaded bore 32 creates a force which urges the rail engaging portion 16 and the table engaging portion 18 in opposing directions.

The first end 42 of the first threaded bolt 36 extends through the first bore 34 where the first threaded bolt 36 includes a groove 45 around a circumference thereof. A snap ring 46, having a larger diameter than an opening through the shoulder 35 within the first bore 34, is disposed within the groove 45 such that the second clamp plate 18 is operably attached to the first threaded bolt 36.

The second securing mechanism 22 also includes a second threaded bore 48 proximate a bottom end of the rail engaging portion 16 and a second bore 50 in the table engaging portion 18 aligned with the second threaded bore 48. A second threaded bolt 52 threadably engages the second threaded bore 48 and operably engages the second bore 50. A wear washer 51 is disposed within the second bore 50 to prevent galling of the table engaging portion 18. The second threaded bolt 52 has a threaded portion 54 proximate a middle of the bolt 52 and a smooth shaft 56 proximate a distal end 58. The distal end 58 of the second threaded bolt 52 extends into the second bore 50 and engages the table engaging portion 18 to provide an opposing force between the table engaging portion 18 and the rail engaging portion 16. A handle 53 is attached to a proximal end 59 of the second threaded bolt 52 to aid in manipulating the second threaded bolt 52.

The second threaded bolt 52 is retractable from the table engaging portion 18 to provide sufficient clearance to allow the clamp 10 to be lifted off of the side rail 14 and positioned on another operating table. A second snap ring 64 is disposed within a second groove 62 proximate the distal end 58 of the second threaded bolt 52. The second snap ring 64 has a larger diameter than the second threaded bore 48 and retains the second threaded bolt 52 within the second threaded bore 48 when threadable engagement between the second threaded bolt 52 and the second threaded bore 48 is disengaged.

Referring to Fig. 3, alignment pins 66, 68 are inserted through first and second alignment bores 70, 72 in the rail engaging portion 16 and first and second alignment bores 74, 76, the table engaging portion 18, respectively, to maintain the alignment of the rail engaging portion 16 and the table engaging portion 18. Additionally, a channel 78 within the rail engaging portion 16 cooperates with the table engaging portion 18 to maintain alignment of the rail engaging portion 16 and the table engaging portion 18.

In operation, the rail engaging portion 16 is positioned such that the side rail 14 is disposed within the slot 30 and the rail engaging portion 16 slidably

engages the side rail 14. After positioning the rail engaging portion 16 about the side rail 14, the second threaded bolt 52 is manipulated to position the distal end 58 of the second threaded bolt 52 proximate the second bore 50.

With the second threaded bolt 52 aligned with the second bore 50  
5 in the table engaging portion 18, the clamp 10 is slidably positioned on the side rail 14 to a selected position. With the clamp 10 in the selected position, the first securing mechanism 20 is manipulated to force the table engaging portion 18 away from the rail engaging portion 16. In the preferred embodiment, a threaded bolt is  
10 used as the force providing mechanism 20 although one skilled in the art will recognize that a camming mechanism, eccentric, or irregularly shaped lobes are within the scope of the invention. The first threaded bolt 52 is manipulated until a top portion of the table engaging portion 18 is adjacent to the top edge of the side 13 of the surgical table 12.

With the top portion 26 of the table engaging portion 18 adjacent to  
15 the side 13 of the surgical table 12, the second threaded bolt 52 is manipulated to urge the bottom portion of the table engaging portion 18 proximate the bottom edge of the side 13 of the surgical table 12. With the top and bottom portions of the second clamp plate 18 adjacent to the side 13 of the surgical table 12, the first and second securing mechanism 20, 22 are further manipulated to displace the  
20 table engaging portion 18 away from the rail engaging portion 16 causing the rail engaging member 16 to move away from the side of the surgical table 12. The first and second securing mechanisms 20, 22 are manipulated until the first clamp plate 24 is adjacent to a side of the side rail 14.

Further manipulation of the first and second securing mechanisms  
25 20, 22 creates an opposing force which frictionally engages the first clamp plate 24 with the side rail 14 and the table engaging portion 18 with the side 13 of the surgical table 12 thereby fixing the clamp 10 in a desired position. One skilled in the art will realize that having an even force along the height of the side rail 14

provides a more secure clamping mechanism than having a clamp engage only either the bottom or top of the side rail 14.

A support member 80 is attached to the top portion 26 of the rail engaging member 16, a portion of which is illustrated in Figs. 1-3. The support member 80 extends upwardly thereby providing a support onto which other retractor supports (not shown) are clamped as described in U.S. Patent No. 5 4,617,916; 4,718,151; 4,949,707 and 6,210,325.

An alternative embodiment of the table rail clamp of the present invention is generally illustrated in Fig. 4 at 110. The clamp 110 includes a rail engaging portion 116 and a table engaging portion 118. The first and second 10 securing mechanisms 120, 122 apply forces to the rail engaging portion 116 and the table engaging portion 118 which move the rail engaging portion 116 and the table engaging portion 118 in opposing directions thereby frictionally securing the table rail clamp 110 between the side rail 114 and the side 113 of the surgical table 112 as best illustrated in Fig. 5.

Referring to Figs. 4-6, the rail engaging portion 116 is designed to slidably engage the side rail 114 and is positionable along the length of the side rail 114. The rail engaging portion 116 includes first clamp plate 124 which is disposed between the side 113 of the surgical table 112 and the side rail 114. The 20 rail engaging portion 116 also includes a top portion 126 which connects the first clamp plate 124 and a retaining portion 128. The retaining portion 128 is spaced apart from the first clamp plate 124 and is positioned substantially parallel to the first clamp plate 124 such that the first clamp plate 124, the top portion 126 and the retaining portion 128 define a slot 130. A width of the slot 130 is greater than a thickness of the side rail 114 allowing the rail engaging portion 116 to freely slide upon the side rail 114 when no force is applied to the rail engaging portion 116.

The table engaging portion 118 preferably is a second clamp plate which is disposed between the side 113 of the surgical table 114 and the first clamp plate 124. The table engaging portion 118 preferably includes a flat surface 119

which engages the side 113 of the table 112 which is also preferably flat. Although the preferred geometric configuration of the table engaging portion 118 is a plate, other geometric configurations are within the scope of the invention.

The table engaging portion 118 is operably attached to the rail  
5 engaging portion 116 by the first securing mechanism 120 and the second securing mechanism 122. The first securing mechanism 120 is disposed above a top surface of the rail 114 and preferably above a top edge of the side 113 of the surgical table 112. The second securing mechanism 122 is disposed below a bottom surface of the side rail 114 and preferably below a bottom edge of the side 113 of the surgical  
10 table 112.

Referring to Fig. 5, the first securing mechanism 120 includes a first threaded bore 132 disposed within the rail engaging portion 116. A first bore 134 within the table engaging portion 118 is aligned with the first threaded bore 132 within the rail engaging portion 116. A first threaded bolt 136 threadably  
15 engages the threaded bore 132 and operably engages the first bore 134 within the table engaging portion 118.

A handle 172 is disposed at a second end 143 extending beyond the rail engaging portion 116 where the handle 172 allows the user of the clamp 110 to manipulate the threaded bolt 136. As the first threaded bolt 136 is rotated, the threaded engagement of the first threaded bolt 136 with the threaded bore 132 creates an opposing force which forces the rail engaging portion 116 and the table engaging portion 118 in opposing directions.  
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A groove 144 is disposed about a circumference of the first threaded bolt 136 proximate a first end 142 where the first end 142 extends through the first bore 134. A snap ring 146 with a diameter larger than an opening defined by a shoulder 135 within the first bore 134, is disposed within the groove 144 such that the table engaging portion 118 is operably attached to the first threaded bolt 136.  
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The second securing mechanism 122 also includes a second threaded bore 148 proximate a bottom end of the rail engaging portion 116 and a second bore 150 in the table engaging portion 118 aligned with the second threaded bore 148. A second threaded bolt 152 threadably engages the second threaded bore 148 and is disposed within the second bore 150 of the table engaging portion 118. A wear washer 151 is disposed within the second bore 150 to prevent galling of the table engaging portion 118. The second threaded bolt 152 has a threaded portion 154 proximate a middle of the bolt 152 and a smooth shaft 156 proximate a distal end 158. The distal end 158 of the second threaded bolt 152 cooperates with the second bore 150 to provide an opposing force between the table engaging portion 118 and the rail engaging portion 116. A handle 174 is disposed at a proximal end 159 of the second threaded bolt 152 to manipulate the position of the rail engaging portion 116 and the table engaging portion 118.

A second snap ring 164 is disposed within a second groove 162 proximate the distal end 158 of the second threaded bolt 152. The second snap ring 164 has a larger diameter than the second threaded bore 148 and retains the second threaded bolt 152 within the second threaded bore 148 when threadable engagement between the second threaded bolt 152 and the second threaded bore 148 is disengaged.

The second threaded bolt 152 is retractable from the table engaging portion 118 to provide the required clearance to allow the clamp 110 to be lifted off of the side rail 114 and positioned on another operating table. To provide the required clearance, the second snap ring 164 is retracted into a cavity 163 within the rail engaging portion 116. Additionally, a channel 176 within the rail engaging portion 116 cooperates with the table engaging portion 118 to maintain alignment of the rail engaging portion 116 and the table engaging portion 118.

In operation, the rail engaging portion 116 is positioned about the side rail 114 such that the side rail 114 is disposed within the slot 130 and the rail engaging portion 116 slidably engages the side rail 114. After disposing the rail

engaging portion 116 about the side rail 114, the second threaded bolt 152 is manipulated to position the distal end 158 of the second threaded bolt 152 proximate the second bore 150.

With the second treaded bolt 152 aligned with the second bore 150  
5 in the table engaging portion 118, the clamp 110 is slidably positioned on the side rail 114 to a selected position. With the clamp 110 in the selected position, the first securing mechanism 120 is manipulated to force the table engaging portion 118 away from the rail engaging portion 116. In the preferred embodiment, a threaded bolt is used as the force providing mechanism 120 although one skilled in the art  
10 will recognize that a camming mechanism, eccentric, or irregularly shaped lobes are within the scope of the invention. The first threaded bolt 152 is manipulated until a top portion of the table engaging portion 118 is adjacent to the top edge of the side 113 of the surgical table 112.

With the top portion 126 of the table engaging portion 118 adjacent  
15 to the side 113 of the surgical table 112, the second threaded bolt 152 is manipulated to urge the bottom portion of the table engaging portion 118 proximate the bottom edge of the side 113 of the surgical table 112. With the top and bottom portions of the second clamp plate 118 adjacent to the side 113 of the surgical table 112, the first and second securing mechanisms 120, 122 are further  
20 manipulated to displace the table engaging portion 118 away from the rail engaging portion 116 causing the rail engaging member 116 to move away from the side of the surgical table 112. The first and second securing mechanisms 120, 122 are manipulated until the first clamp plate 124 is adjacent to a side of the side rail 114.

25 Further manipulation of the first and second securing mechanisms 120, 122 creates an opposing force which frictionally engages the first clamp plate 124 with the surface of the side rail 114 and the table engaging portion 118 with the side 113 of the surgical table 112 thereby fixing the clamp 110 in a desired position as illustrated in Fig. 5. One skilled in the art will realize that having an

even force along the height of the side rail 114 provides a more secure clamping mechanism than having a clamp engage only either the bottom or top of the side rail 114.

A support member 180 is attached to the top portion 126 of the rail  
5 engaging member 116, a portion of which is illustrated in Figs. 4-6. The support member 180 extends upward thereby providing a support onto which other retractor supports (not shown) are clamped.

Although the present invention has been described with reference to preferred embodiments, workers skilled in the art will recognize that changes  
10 may be made in form and detail without departing from the spirit and scope of the invention.